



# Preparation Guide

Edition 202207

# Content

# 1. Overview

This Preparation Guide covers two different EXIN certifications:

1. **EXIN LSSA Lean Six Sigma Green Belt** (LSSGB.EN)
2. **EXIN LSSA Lean Six Sigma Green Belt Specialist** (LSSGBS.EN)

## Scope

**EXIN LSSA Lean Six Sigma Green Belt**
It is possible to gain the EXIN LSSA Lean Six Sigma Green Belt certification separately. Candidates interested in the EXIN LSSA Lean Six Sigma Green Belt certification may disregard the practical project assessment criteria, since this exam does not require practical projects.

**EXIN LSSA Lean Six Sigma Green Belt Specialist**
To gain the EXIN LSSA Lean Six Sigma Green Belt Specialist certification, candidates must finish the required practical projects in addition to gaining the EXIN LSSA Lean Six Sigma Green Belt certification. Candidates interested in the EXIN LSSA Lean Six Sigma Green Belt Specialist certification can find the project criteria in section 3. Practical Project Assessment Criteria.

**Certification value**
Both EXIN LSSA Lean Six Sigma Green Belt and EXIN LSSA Lean Six Sigma Green Belt Specialist certifications validate a candidate's knowledge on:

- world-class performance
- policy development and deployment
- project management
- creating a solid foundation
- creating a continuous improvement culture
- creating stable and efficient processes
- creating capable processes

The EXIN LSSA Lean Six Sigma Green Belt Specialist certification also validates a candidate's skills and competences in those same areas through the practical projects.

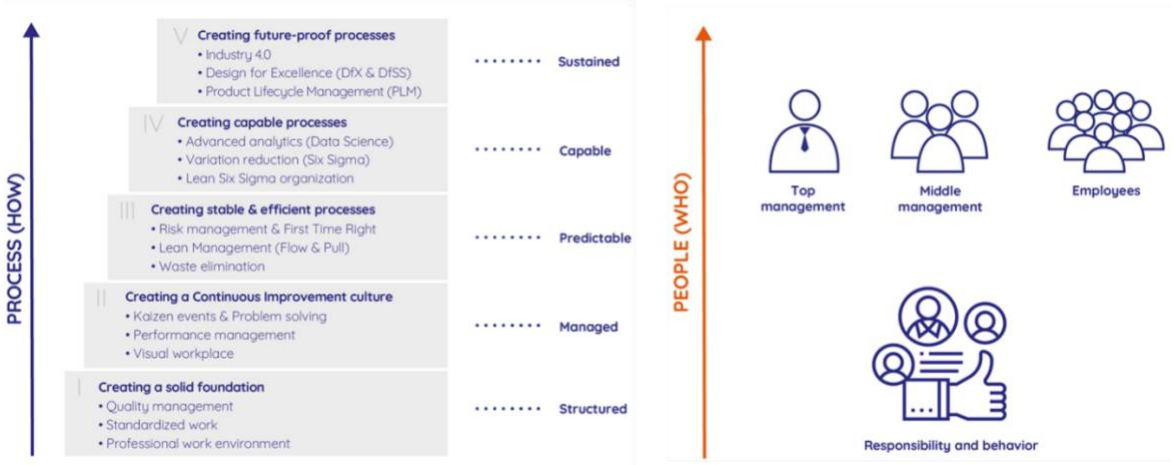
## Summary

The LSSA (Lean Six Sigma Academy®) was established in September 2009 with the objective to develop an international recognized certification scheme for all Lean and Six Sigma Belt levels. For each level the LSSA Exam Board has developed preparation guides with clear criteria for skills and competences. These preparation guides specify which of the overall Lean and Six Sigma techniques are expected to be included within certain Belt level competencies.

CIMM summarizes best practices and techniques of different methodologies in one framework, for different stages of maturity. The CIMM framework describes five consecutive stages:

- creating a solid foundation
- creating a continuous improvement culture,
- creating stable and predictable processes
- creating capable processes and
- creating future-proof processes.

For Lean Six Sigma all five levels apply.




For each instrumental technique in the CIMM framework, it is possible to indicate the associated desired behavior. The CIMM framework identifies a number of behaviors for each improvement technique, which helps determine whether or not the implementation of the technology in question will be a success and results in a lasting impact.

### Context

The EXIN LSSA Lean Six Sigma Green Belt and EXIN LSSA Lean Six Sigma Green Belt Specialist certifications are part of the EXIN LSSA Lean Six Sigma qualification program.


## Target group

Lean Six Sigma Green Belts are specialists in executing Lean Six Sigma projects. With the right combination of specialist expertise, statistical analysis and structured Lean Six Sigma methodology, the Green Belt is able to achieve significant improvements in performance and quality. The impact on the organization and savings can be as large as a Black Belt project, but in general Lean Six Sigma Green Belt projects have a smaller scope and are less complex than Black Belt projects. The scope of the project is often within one department, process, or expertise rather than across departments.

Lean Six Sigma Green Belts might work alone or as a project manager in a team. Team members can be other Belts or employees without specific Lean Six Sigma competencies. Lean Six Sigma Green Belts can also be team members in larger Black Belt projects. We can distinguish Lean Green Belts, that are working on improvement projects and Lean Six Sigma Green Belts that are working on more data driven projects. Lean Six Sigma Green Belts master all Lean techniques as well as additional statistical and analytical Six Sigma techniques.

## Requirements for certification

**EXIN LSSA Lean Six Sigma Green Belt**

- Successful completion of the EXIN LSSA Lean Six Sigma Green Belt exam.
- Accredited EXIN LSSA Lean Six Sigma Green Belt training, including completion of the training assignments.

**EXIN LSSA Lean Six Sigma Green Belt Specialist**

- EXIN LSSA Lean Six Sigma Green Belt certification is a pre-requisite to subscribe for the practical assessment.
- Successful completion of the EXIN LSSA Lean Six Sigma Green Belt Specialist assessment.

Candidates are required to pass both elements to be recognized as a certified Lean Six Sigma Green Belt Specialist. Candidates will receive the Specialist certificate if they pass the practical assessment (EXIN LSSA Lean Six Sigma Green Belt Specialist) within a maximum period of three years after achieving the EXIN LSSA Lean Six Sigma Green Belt certification.

## Examination details

**EXIN LSSA Lean Six Sigma Green Belt**

| | |
|---|---|
| Examination type: | Multiple-choice questions |
| Number of questions: | 60 |
| Pass mark: | 63% (38/60 questions) |
| Open book: | Literature source A and the Preparation Guide may be consulted throughout the exam. Candidates are required to bring their own copy for both the online and the paper-based exams. The exercise books are not allowed during the exam. |
| Notes: | No |
| Electronic equipment/aides permitted: | A calculator is permitted. Candidates are required to bring their own calculator or statistical software (e.g. Minitab) to the exam. |
| Exam duration: | 180 minutes |

The Rules and Regulations for EXIN's examinations apply to this exam.

**EXIN LSSA Lean Six Sigma Green Belt Specialist**
The assessment criteria for the practical part include the submission of two practical projects that meet the following criteria:

- One successful project at CIMM level-IV or higher.
- The project should have a significant impact on the organization (e.g. a financial impact of €20,000,- or a relevant Critical to Quality (CTQ) has substantially been improved).
- The project must follow the DMAIC or DMADV roadmap.
- The templates for submitting the project can be downloaded from the LSSA website (max. of 25 pages).
- The project should be signed off by the Champion to declare that the project has been carried out professionally and that objectives have been achieved and sustainable.
- A single Green Belt can submit the project for certification in its role of project manager.

The project will be assessed by a Master Black Belt, assigned by the LSSA. The criterion listed in 3. Practical Project Assessment Criteria will be applied. It is advisable to use these criteria during your project. It is additionally strongly advised that the submission is also checked by an internal (Master) Black Belt or coach.

- A 'Pass' result will be awarded when all criteria are addressed within the submission and are deemed to be 'Correct' or 'Not Applicable'.
- The submission must contain a justification of any criteria that is claimed to be 'Not Applicable'.

The result of the practical assessment will be either Pass or Fail. No score will be given. In the event of a 'Fail' result, brief guidance will be given on those criteria that are deemed 'Missing' or 'Incorrect'. Subsequently, a single retake resubmission is allowable.

## Bloom level

The EXIN LSSA Lean Six Sigma Green Belt and EXIN LSSA Lean Six Sigma Green Belt Specialist certifications test candidates mainly at Bloom level 2 and 3 according to Bloom's Revised Taxonomy:

- Bloom level 2: Understanding - a step beyond remembering. Understanding shows that candidates comprehend what is presented and can evaluate how the learning material may be applied in their own environment. This type of questions aims to demonstrate that the candidate is able to organize, compare, interpret, and choose the correct description of facts and ideas.
- Bloom level 3: Application - shows that candidates have the ability to make use of information in a context different from the one in which it was learned. This type of questions aims to demonstrate that the candidate is able to solve problems in new situations by applying acquired knowledge, facts, techniques, and rules in a different, or new way. These questions usually contain a short scenario.

# Training

## Contact hours

The recommended number of contact hours for the EXIN LSSA Lean Six Sigma Green Belt training course is 64. This includes practical assignments, exam preparation and short breaks. This number of hours does not include lunch breaks, homework, and the exam.

## Indication study effort

**EXIN LSSA Lean Six Sigma Green Belt**
112 hours (4 ECTS), depending on existing knowledge.

**EXIN LSSA Lean Six Sigma Green Belt Specialist**
EXIN Lean Sig Sigma Green Belt + 112 hours (4 ECTS) = 224 hours (8 ECTS), depending on existing knowledge.

## Training organization

You can find a list of our Accredited Training Organizations at www.exin.com.

# 2. Exam requirements

The exam requirements are specified in the exam specifications. The following table lists the topics of the module (exam requirements) and the subtopics (exam specifications).

| Exam requirements | Exam specifications | Weight |
|---|---|---|
| **1. World-class performance** | | **10%** |
| | 1.1 Continuous improvement | |
| | 1.2 Customer value (VOC & CTQ) | |
| **2. Policy development and deployment** | | **1.7%** |
| | 2.1 Policy development | |
| | 2.2 Policy deployment | |
| | 2.3 Competence development | |
| **3. Project management** | | **6.7%** |
| | 3.1 Managing a project | |
| | 3.2 Process improvement roadmaps | |
| **4. Creating a solid foundation** | | **3.3%** |
| | 4.1 Professional work environment | |
| | 4.2 Standardize work | |
| | 4.3 Quality management | |
| **5. Creating a continuous improvement culture** | | **8.3%** |
| | 5.1 Visual management | |
| | 5.2 Performance management | |
| | 5.3 Basic quality tools | |
| **6. Creating stable and efficient processes** | | **28.3%** |
| | 6.1 Process mapping (Define) | |
| | 6.2 Performance metrics (Measure) | |
| | 6.3 Basic statistics (Measure) | |
| | 6.4 Value stream analysis (Analyze) | |
| | 6.5 Reducing Muda (Waste) (Improve) | |
| | 6.6 Reducing Muri (Overburden) (Improve) | |
| | 6.7 Reducing Mura (Unevenness) (Improve) | |
| | 6.8 Value stream improvement (Improve) | |
| | 6.9 Process and quality control (Control) | |
| | 6.10 Total Productive Maintenance (TPM) (Control) | |
| **7. Creating capable processes** | | **41.7%** |
| | 7.1 Statistical techniques (Measure) | |
| | 7.2 Distributions (Measure) | |
| | 7.3 Measurement systems (Measure) | |
| | 7.4 Hypothesis testing and confidence intervals (Analyze) | |
| | 7.5 Tests for means, variances, and proportions (Analyze) | |
| | 7.6 Correlation and regression (Analyze) | |
| | 7.7 Process capability and performance (Analyze) | |
| | 7.8 Design of Experiments (DOE) (Improve) | |
| | 7.9 Statistical Process Control (SPC) (Control) | |
| | **Total** | **100%** |

## Exam specifications

**1 World-class performance**

The unit 'world-class performance' reviews the general philosophy of continuous improvement. It discusses the overview of different process improvement methods and the history of the most important methodologies. It also explains why continuous improvement is important.

1.1 Continuous improvement

The learning element 'continuous improvement' reviews the history, values, and principles of the most common process improvement methodologies. Also, the culture within a continuous improvement organization as well as roles and responsibilities are reviewed.

The candidate can…

1.1.1 understand the origins of quality management, TPM, Kaizen, Lean, Six Sigma and Agile.

1.1.2 propagate the Lean Six Sigma philosophy and principles.

1.1.3 understand the impact of the Toyota Production System (TPS) on strategy, quality, and production.

1.1.4 facilitate the creation of a continuous improvement culture within the organization.

1.1.5 facilitate the development of the organization's maturity level, which is a combination of developing people and processes.

1.1.6 describe the various continuous improvement roles and responsibilities.

1.2 Customer value (VOC & CTQ)

The learning element 'customer value' reviews customer identification (internal/external), customer requirements and the Critical to Quality (CTQ)-measure.

The candidate can…

1.2.1 differentiate customer experience into dissatisfied, expected, satisfied and desired quality levels (e.g. KANO model).

1.2.2 convert the Voice of the Customer (VOC) into external CTQs and internal CTQs.

1.2.3 construct a CTQ-flowdown that represents the key measurable characteristics of a product or process whose performance standards or specification limits must be met.

**2 Policy development and deployment**

The unit 'policy development and deployment' reviews how policy development and deployment help organizations in defining a continuous improvement strategy and to run efficiently in achieving their objectives.

2.1 Policy development

The learning element 'policy development' explains the importance of a so-called True North and how to develop an operational excellence strategy.

The candidate can…

2.1.1 recall and understand the organization's vision and mission statement.

2.1.2 understand the meaning and importance of the organization's True North.

2.1.3 describe how Operational Excellence can be applied to processes in different types of enterprises.

2.1.4 understand the meaning of a transition roadmap for implementing continuous improvement.

2.1.5 understand that various business processes have various key performance indicators (KPIs).

2.1.6 understand the basics of measurement systems in the organization.

2.1.7 define and use cost of poor quality (COPQ) as a financial metric.

2.2 Policy deployment

The learning element 'policy deployment' is focusing on the execution process of the improvement strategy. Within this element financial and performance metrics will be reviewed.

The candidate can…

2.2.1 understand breakthrough projects can have an impact on process owners, internal and external customers, and other stakeholders.

2.2.2 participate in developing a stakeholder analysis.

2.3 Competence development

The learning element 'competence development' reviews how to develop those who need to ensure that the strategy is implemented successfully.

The candidate can…

2.3.1 identify and document lessons learned from all phases of a project.

2.3.2 identify possible improvements and ownership.

2.3.3 understand the importance of coaching.

2.3.4 use effective and appropriate communication for different situations to overcome barriers to project success.

## 3 Project management

The unit 'project management' outlines the way improvement projects should be executed. A number of process improvement roadmaps is reviewed. The Unit also reviews project selection, team formation, planning, and execution.

3.1 Managing a project

The learning element 'managing a project' reviews how to set up, plan, and execute a project.

The candidate can…

3.1.1 understand that project selection needs to be aligned with the strategy of the organization.

3.1.2 participate in the project selection process.

3.1.3 prepare the project charter in relation to customer requirements and business goals.

3.1.4 define the problem statement, project boundaries (scope), objectives, benefits, and measurable targets for the project.

3.1.5 understand the basic principles of team formation and team member selection.

3.1.6 select and construct time-management techniques.

3.1.7 set up team meetings, tollgates and publish agendas and ensure that the proper people and resources are available.

3.1.8 demonstrate project-management skills and apply the proper tools and techniques.

3.1.9 ensure that the project will meet its requirements for time, quality, and costs.

3.2 Process improvement roadmaps

The learning element 'process improvement roadmaps' reviews a number of roadmaps, including PDCA and DMAIC.

The candidate can…

3.2.1 apply project management methods that can be used in the workplace for Kaizen initiatives (e.g. PDCA, A3-report).

3.2.2 apply the DMAIC roadmap for Lean (Six Sigma) projects.

3.2.3 select the proper tools to use during the project.

3.2.4 facilitate the problem-solving process (e.g. 8D approach).

3.2.5 understand Scrum roles, elements and artifacts.

## 4 Creating a solid foundation

The unit 'creating a solid foundation' reviews how to achieve a solid foundation for further process improvement programs. This foundation consists of a proper and organized work environment, reliable equipment, and standardized work.

4.1 Professional work environment

The learning element 'professional work environment' is about good housekeeping and how to set up a proper and safe work environment in a structured manner.

The candidate can…

4.1.1 organize the work environment by applying 5S (Sort, Straighten, Shine, Standardize, Sustain).

4.1.2 understand that an organized environment will improve safety and moral.

4.2 Standardize work

The learning element 'standardized work' is about implementing and improving standards and protocols.

The candidate can…

4.2.1 standardize tasks and processes to establish the foundation for continuous improvement.

4.2.2 prepare documents, standard operating procedures (SOPs), and one-point-lessons to ensure that the improvements are sustained over time.

4.2.3 understand the basic principles of Training Within Industry.

4.3 Quality management

The learning element 'quality management' is about developing procedures to identify and detect defects. Also preventing mistakes and avoiding problems are part of this element.

The candidate can…

4.3.1 propagate the quality management system and procedures.

4.3.2 identify opportunities for improvement.

## 5 Creating a continuous improvement culture

The unit 'creating a continuous Improvement culture' reviews how to create a continuous improvement culture at the shop floor. This Unit reviews setting up and facilitate Kaizen teams. It also reviews a number of problem-solving techniques and tools.

5.1 Visual management

The learning element 'visual management' reviews how to set up a workplace that is organized and self-explaining.

The candidate can…

5.1.1 apply the elements of Visual Workplace and describe how they can help to control the improved process.

5.2 Performance management

The learning element 'performance management' reviews how to set targets, and how to organize the work to be done. The learning element also reviews how to facilitate improvement teams at the shopfloor that work on Kaizen improvement initiatives and problem solving.

The candidate can…

5.2.1 implement and facilitate stand-up meetings to drive continuous improvement initiatives.

5.2.2 understand basic principles of Scrum.

5.2.3 describe and propagate the Kaizen principles.

5.2.4 facilitate improvement teams and Kaizen events.

5.2.5 define and apply root cause analysis (RCA), recognize the issues involved in identifying a root cause.

5.2.6 apply problem solving process and tools.

5.3 Basic quality tools

The learning element 'basic quality tools' reviews techniques to visualize data and guidelines how to facilitate and participate in brainstorm sessions.

The candidate can…

5.3.1 apply brainstorm techniques: Affinity diagram, 5-Why's and Ishikawa.

5.3.2 apply basic quality tools to visualize data: Scatter plot, Pareto chart, Bar chart, Pie chart, Time Series Plot, Histogram and Box plot.

## 6 Creating stable and efficient processes

The unit 'creating stable and efficient processes' reviews how the logistical flow of processes can be improved and made more stable, predictable, and efficient. This unit reviews tools which can be used to visualize and analyze the process flow as well as a number of tools and techniques that can be used to improve efficiency, effectiveness, productivity, and agility of processes. All learning elements and performance criteria in this unit follow the DMAIC structure.

6.1 Process mapping (Define)

The learning element 'process mapping' reviews a number of tools to map and analyze the flow of a process.

The candidate can…

6.1.1 describe key process input variables (KPIV) and key process output variables (KPOV) based on a high-level process map (e.g. SIPOC).

6.1.2 apply process mapping to visualize the flow of activities and decisions within a process.

6.2 Performance metrics (Measure)

The learning element 'performance metrics' reviews performance metrics for both logistics and quality.

The candidate can…

6.2.1 calculate performance metrics related to time (e.g. takt time, cycle time, lead time, queue time, WIP and OEE).

6.2.2 apply Little's Law.

6.2.3 calculate performance metrics related to quality (e.g. ppm, DPMO, DPU and RTY).

6.2.4 understand the difference between a defect and a defective.

6.3 Basic statistics (Measure)

The learning element 'basic statistics' reviews different types of data, measurement scales, and data collection tools. Also, a set of measures (statistics) that characterizes a given set of data are reviewed.

The candidate can…

6.3.1 understand the importance of reliable and accurate data.

6.3.2 describe and review qualitative and quantitative data, continuous (variables) and discrete (attributes) data.

6.3.3 define and interpret nominal, ordinal, interval and ratio measurement scales.

6.3.4 apply Likert scale to convert an ordinal scale into a discrete interval scale.

6.3.5 define and apply tools for collecting data e.g. data sheets, check sheets, concentration diagrams and questionnaires.

6.3.6 calculate population parameters and sample statistics: measures of central tendency, measures of dispersion, ratios and proportions.

6.4 Value stream analysis (Analyze)

The learning element 'value stream analysis' reviews how to create a Value Stream Map of the current situation.

The candidate can…

6.4.1 differentiate value adding from non-value adding and necessary activities.

6.4.2 apply Value Stream Mapping (VSM) to construct a current state map of the process to identify Waste and non-value adding activities.

6.5 Reducing Muda (Waste) (Improve)
The learning element 'reducing Muda' reviews how to identify and eliminate Waste in the organization and its processes.
The candidate can…
6.5.1 identify and eliminate process Waste (Muda): Overproduction, Waiting, Transport, Overprocessing, Inventory, Movement, Defects and Unused expertise.

6.6 Reducing Muri (Overburden) (Improve)
The learning element 'reducing Muri' reviews how to identify overburden in the organization. This element also reviews how to implement flow and work balancing to reduce overburden.
The candidate can…
6.6.1 describe the importance of flow for reducing Muri.
6.6.2 implement flow in the organization.
6.6.3 describe the importance of Work balancing for reducing Muri.
6.6.4 implement Work balancing.
6.6.5 describe how competence management supports the reduction of Muri.

6.7 Reducing Mura (Unevenness) (Improve)
The learning element 'reducing Mura' reviews how to identify unevenness in the organization and its processes. This element also reviews a number of techniques to reduce unevenness.
The candidate can…
6.7.1 describe the importance of pull for reducing Mura.
6.7.2 implement pull in the organization by applying Kanban systems.
6.7.3 implement a balanced process flow by both volume leveling, type leveling, and one piece flow.
6.7.4 reduce change over times by implementing Single Minute Exchange of Die (SMED).

6.8 Value stream improvement (Improve)
The learning element 'value stream improvement' reviews how the techniques and tools that reduce Muda, Muri and Mura can be applied in constructing a future-state Value Stream Map.
The candidate can…
6.8.1 define the gap between the current state and the target condition.
6.8.2 define a future-state map using Value Stream Mapping (VSM).
6.8.3 apply techniques to reduce Muda, Mura and Muri.

6.9 Process and quality control (Control)
The learning element 'process and quality control' looks at how results that have been achieved in process improvement projects can be sustained. This element reviews the following techniques and principles: Process FMEA, Control plan, Jidoka and Poka Yoke.
The candidate can…
6.9.1 propagate the importance of the First Time Right principle.
6.9.2 initiate actions to implement First Time Right.
6.9.3 propagate the line has to be stopped when there is a quality problem (Jidoka).
6.9.4 apply Poka Yoke to avoid quality problems.
6.9.5 describe the purpose and elements of Process FMEA, including the risk priority number (RPN) and evaluate FMEA results for processes, products and services.
6.9.6 prepare a control plan to document and hold gains.
6.9.7 define controls and monitoring systems.
6.9.8 transfer of responsibility from the project team to the process owner.

6.10 Total Productive Maintenance (TPM) (Control)
The learning element 'Total Productive Maintenance (TPM)' reviews the coherence between reliable systems and equipment and continuous improvement.
The candidate can…
6.10.1 understand the eight pillars of TPM and understand how it can be used within process improvement.
6.10.2 interpret the Overall Equipment Effectiveness (OEE) performance metric.
6.10.3 review utilization.

## 7 Creating capable processes

The unit 'creating capable processes' focuses on reducing variation in a stable process with the objective to create a process capable of meeting customer requirements. This unit reviews the application of Six Sigma and statistical tools used to assure a valid and reliable performance measurement system, to collect data and to analyze the performance of processes. Six Sigma focuses on quality breakthrough improvement projects. All learning elements and performance criteria in this unit follow the DMAIC structure.

7.1 Statistical techniques (Measure)
The learning element 'statistical techniques' reviews a number of metrics that are often used in Six Sigma projects. The element also reviews a number of sampling methods for assuring data accuracy and integrity.
The candidate can…
7.1.1 divide special cause and common cause variation.
7.1.2 apply appropriate sampling methods that ensure representative data (e.g. random sampling, stratified sampling and systematic sampling).
7.1.3 calculate power and sample size for common hypothesis tests.

7.2 Distributions (Measure)
The learning element 'distributions' reviews a number of continuous and discrete distributions. The element also reviews the central limit theorem and a number of probability concepts.
The candidate can…
7.2.1 interpret Probability Density Functions and Cumulative Distribution Functions.
7.2.2 interpret continuous distributions: Normal, Weibull, Student's t, Chi square and F distributions.
7.2.3 interpret normality test (Anderson-Darling; Skewness and Kurtosis).
7.2.4 interpret discrete distributions: Poisson, Binomial.
7.2.5 understand the central limit theorem.

7.3 Measurement systems (Measure)
The learning element 'measurement systems' reviews how to evaluate measurement systems.
The candidate can…
7.3.1 define and describe measurement methods for both continuous and discrete data.
7.3.2 apply measurement systems for continuous data.
7.3.3 interpret repeatability and reproducibility (R&R), stability, bias, linearity, precision to tolerance and number of distinct categories.

7.4 Hypothesis testing and confidence intervals (Analyze)
The learning element 'hypothesis testing and confidence intervals' reviews test methods that are used to test a hypothesis. This learning element also discusses confidence intervals that indicate the reliability of test conclusions.
The candidate can…
7.4.1 define and interpret the significance level, power, type I, and type II errors in statistical tests.
7.4.2 define and distinguish between confidence, prediction, and tolerance intervals.
7.4.3 distinguish between statistical and practical significance.

7.5 Tests for means, variances, and proportions (Analyze)
The learning element 'tests for means, variances, and proportions' reviews the most common hypothesis tests to investigate the difference between population means (μ); difference in variances (σ); difference in proportion (p) and difference in counts (λ). Also, the ANOVA analysis is reviewed.
The candidate can…
7.5.1 apply hypothesis tests for means.
7.5.2 apply hypothesis tests for variances.
7.5.3 apply ANOVA.
7.5.4 interpret the results and the main effect and interaction plots.
7.5.5 apply hypothesis tests for proportions.
7.5.6 apply Chi-square goodness-of-fit test and Contingency tables.

7.6 Correlation and regression (Analyze)
The learning element 'correlation and regression' describes the predictive models using regression techniques to determine the relation between factors on a response.
The candidate can…
7.6.1 calculate and interpret the correlation coefficient.
7.6.2 determine its statistical significance (p-value) and recognize the difference between correlation and causation.
7.6.3 apply linear regression analysis.
7.6.4 use the regression model for estimation and prediction.
7.6.5 interpret the residual analysis to validate the model.

7.7 Process capability and performance (Analyze)
The learning element 'process capability and performance' explains process capability and performance in relation to specification limits.
The candidate can…
7.7.1 apply process capability studies.
7.7.2 prepare sampling plans to verify stability.
7.7.3 calculate and interpret process capability indices: Cp and Cpk to assess process capability.
7.7.4 interpret the relationship between long-term and short-term capability.
7.7.5 calculate and interpret process performance indices Pp and Ppk to assess process performance.
7.7.6 interpret the relationship between capability and performance indices.

7.8 Design of Experiments (DOE) (Improve)
The learning element 'Design of Experiments (DOE)' reviews efficient ways of experimenting. DOE examines the influence of factors and interactions on a process.
The candidate can…
7.8.1 apply DOE elements: responses, factors, levels, transfer function, run order, randomization, balanced designs, residual error, main effects, interaction effects, replicates, and repetitions.
7.8.2 design and apply full factorial experiments.
7.8.3 understand the meaning of contrast.

7.9 Statistical Process Control (SPC) (Control)
The learning Element 'Statistical Process Control (SPC)' explains the controls methods used to identify out-of-control situations and deviations over time. Different types of SPC charts are reviewed.
The candidate can…
7.9.1 describe the objectives of SPC.
7.9.2 select and apply control charts: Xbar-R, Xbar-S, individuals and moving range (I-MR), p, np, c and u.
7.9.3 interpret control charts and differentiate between common and special cause variation using rules for determining statistical control.

# 3. Practical Project Assessment Criteria

## Kaizen & Lean project criteria PDCA

| Phase | Nr | Criteria |
|---|---|---|
| Plan | 1 | The project addresses a customer complaint, problem, or business case. |
| | 2 | There is a clear problem definition. |
| | 3 | Objectives are clearly defined and are measurable. |
| | 4 | VOC and VOB are defined, and specifications are clear. |
| | 5 | The scope of the project is clearly defined. |
| | 6 | The most important stakeholders have been identified. |
| | 7 | Relevant CTQ(s) have been selected and a CTQ-flowdown has been made. |
| | 8 | A high-level process description has been made (e.g. SIPOC). |
| | 9 | The reliability of the data has been investigated. |
| | 10 | Process performance has been constructed and assessed against specifications. |
| | 11 | A detailed process description has been made (e.g. VSM Current State). |
| | 12 | Potential causes have been identified. |
| | 13 | Analyzes have been used to identify factors of influence (e.g. Fishbone or FMEA). |
| | 14 | The main root causes have been identified and explained. |
| | 15 | Conclusions are clear and supported. |
| Do | 1 | Risks have been defined and addressed (e.g. pFMEA). |
| | 2 | The improved process meets the specifications of the VOC and VOB. |
| | 3 | There is a clear communication and action plan towards the stakeholders. |
| | 4 | The client has approved the improvement proposals. |
| Check | 1 | There is a proven improvement of the CTQ compared to the baseline measurement. |
| | 2 | Standards have been adjusted and documentation has been updated. |
| | 3 | Roles and responsibilities have been described. |
| | 4 | Employees are instructed and/or trained. |
| | 5 | It has been shown that the improvements are sustainable. |
| Act | 1 | It has been indicated how performance will be monitored in the future. |
| | 2 | Final report is ready, and lessons learned have been communicated. |
| | 3 | Champion has indicated that objectives and/or savings have been achieved. |
| | | |

## Kaizen & Lean project criteria DMAIC

| Phase | Nr | Criteria |
|---|---|---|
| Define | 1 | Project addresses a clear problem description or business opportunity. |
| | 2 | Problem description has been clearly defined. |
| | 3 | Goals have been clearly defined and are measurable. |
| | 4 | VOC and VOB have been clearly defined, and requirements are understood. |
| | 5 | Scope of the project has been clearly delineated. |
| | 6 | Key stakeholders have been identified. |
| | 7 | Relevant CTQ(s) have been selected and a CTQ-flowdown has been constructed. |
| | 8 | High-level process description has been made (e.g. SIPOC). |
| Measure | 1 | The collected data has been proven to be representative for the project. |
| | 2 | Validity of the data has been verified in an appropriate way. |
| | 3 | Historical data has been used to visualize process performance over time. |
| | 4 | Performance against requirements has been checked. |
| | 5 | Variation in the process has been considered (common cause or special cause). |
| | 6 | Short-term versus long-term performance has been considered. |
| Analyze | 1 | Process has been mapped in detail (e.g. VSM current state). |
| | 2 | Potential factors of influence have been determined. |
| | 3 | Analyses have been used to identify factors with highest influence. |
| | 4 | Hypothesis for root cause has been defined properly. |
| | 5 | Input data has been collected and analyzed correctly. |
| | 6 | Graphical and statistical techniques have been applied to investigate root causes. |
| | 7 | Major root causes have been identified. |
| | 8 | Conclusions are clear and have demonstrated strong evidence/are statistically valid. |
| Improve | 1 | Risks have been identified and addressed (e.g. pFMEA). |
| | 2 | Improved process meets the requirements of the VOC and VOB. |
| | 3 | There is a clear communication and action plan towards the stakeholders. |
| | 4 | The client (Champion) has approved the improvement proposal. |
| | 5 | An improvement of the CTQ compared to the baseline is demonstrated. |
| Control | 1 | Standards are adjusted and documentation has been updated (pFMEA, CP). |
| | 2 | Rolls and responsibilities have been described. |
| | 3 | Employees are instructed and/or trained. |
| | 4 | Evidence of 'in-control situation' is available and sufficient. |
| | 5 | Improvements have proven to be sustainable. |
| | 6 | Measures have been put in place to monitor process performance. |
| | 7 | Project report has been completed. Lessons learned have been communicated. |
| | 8 | Champion states that project targets and/or savings have been achieved. |
| | 9 | Champion or controller has signed off the project. |
| | | |

# 4. Literature

## Exam Literature

The knowledge required for the exam is covered in the following literature:

**A.** H.C. Theisens
**Climbing the Mountain: Lean Six Sigma Green Belt. Mindset, Skill set & Tool set.**
LSSA B.V. (fifth edition, April 2021)
ISBN: 9789492240323 (hardcopy)

## Additional Literature

**B.** H.C. Theisens
**Climbing the Mountain: Lean Six Sigma Green & Black Belt. Exercise book.**
LSSA B.V. (second edition, January 2022)
ISBN: 9789492240385 (hardcopy)

**C.** H.C. Theisens
**Climbing the Mountain: Lean Six Sigma Yellow Belt. Mindset, Skill set & Tool set.**
LSSA B.V. (fourth edition, January 2022)
ISBN: 9789492240330 (hardcopy)

**D.** H.C. Theisens
**Climbing the Mountain: Lean Six Sigma Orange Belt. Mindset, Skill set & Tool set.**
LSSA B.V. (first edition, March 2021)
ISBN: 9789492240248 (hardcopy)

**E.** H.C. Theisens
**Climbing the Mountain: Lean Six Sigma Black Belt. Mindset, Skill set & Tool set.**
LSSA B.V. (third edition, January 2022)
ISBN: 9789492240354 (hardcopy)

### Comment

Additional literature is for reference and depth of knowledge only.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